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PhD Students' Research Group Networks. A Qualitative Approach

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Abstract

This article examines the networks within the research groups where Spanish PhD students are pursuing their doctorate. Capó et al. (2007) used quantitative data to predict PhD students' publishing performance from their background, attitudes, supervisors' performance and research group networks. Variables related to the research group network had a negligible explanatory power on student performance once the remaining variables had been accounted for. In this article, a qualitative follow–up of the same students is carried out using extreme case sampling and in–depth interviews. The qualitative research shows networking as important for students. Out of the 115 aspects that students mention in the interviews as relevant to publishing in the qualitative research, 92 have to do with their supervisors, their research group or their network as a whole. Similarly, out of the 50 hindrances mentioned, 20 have to do with the networks or relations. The most commonly mentioned network-related topics are research group members pushing PhD students to publish, meeting researchers outside the research group, existence of other PhD students in the group, help with the PhD from group members, supervisor's interest in the thesis, the possibility of discussing with experts on the PhD's topic and frequent contact with the supervisor and research group members. Some of these characteristics were not, however, measured in the conventional quantitative social network survey.

1 Introduction

This study belongs to a wider project designed to predict PhD students' academic performance carried out by the INSOC research group (International Network on Social Capital and Performance). The INSOC research group is composed of

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researchers of the universities of Girona (Catalonia, Spain), Ljubljana (Slovenia), Giessen (Germany) and Gent (Belgium). A key point for the academic quality of higher education is that future professionals achieve the highest academic performance. These future professional candidates are today's PhD students. Therefore, finding the main reasons that make a PhD student successful, in terms of higher performance, is a fundamental aspect in generating quality in higher education. Furthermore, knowing which are these influential elements is relevant for research groups at universities in order to select and hire the most adequate future professionals, that is, PhD students, and to promote working conditions that foster and increase their performance. The aim of the INSOC research group is to study the determinants of PhD students' academic performance across the INSOC member universities.

Performance in creative teams or working groups has been approached from both managerial/innovation and education perspectives and even from both disciplines simultaneously, as some key variables like mentoring operate in a similar fashion (Paglis et al., 2006). In the long run PhD students' performance is evaluated by the broader scientific community in terms of attended conferences and published papers. Our choice in this article is, thus, to consider performance from this view point in a way similar to Green and Bauer (1995).

A first group of authors studying creative or academic performance stress the role of the personal background. For instance, Cohen and Levinthal (1990) related levels of education and experience to knowledge creation.

Another group of authors focused on the role of attitudinal variables such as group atmosphere, job satisfaction or motivation. Ivankova and Stick (2007) found that self-motivation and an online learning environment were predictive variables of PhD performance. Wentzel and Wigfield (1998) pointed to the importance of the motivation of students. Similar findings are also found in the managerial field (e.g., Nonaka and Takeuchi, 1995).

A third group of authors worked on the role of social network relationships within groups, including trust and communication among social network members (Hemlin et al., 2004; Wasserman and Faust, 1994). The basic idea behind this perspective is that an individual's success is strongly dependent on the relations with relevant others inside and outside the organisation (Burt, 2000). The importance of social relations in the network structure concerning individual performance can be captured by the concept of social capital. The key points are the relationship between students and supervisor (Cryer, 1996), with the research group as a whole (Hemlin et al., 2004) and socialization (Austin, 2002). On the other hand, being isolated in a research group can be one of the main problems for a PhD student (Rudd, 1984).

Capó et al. (2007) used data from the INSOC project to predict PhD students' academic performance from their background, attitudes, supervisors' performance and research group networks using Slovenian and Spanish data. Variables related to the research group network had a negligible explanatory power on student

performance once the remaining variables had been included. This was specially so for the Spanish data collected in the University of Girona. For that data set, frequency of supervisor contact was the only statistically significant network predictor on performance. Besides, against any previous expectation, frequent supervisor advice was found to be detrimental to student performance. Coromina (2006), following a different approach, found no significant network variables whatsoever.

In this article we report a qualitative follow–up study of the same PhD students who participated in the initial quantitative research with the aim of understanding the unexpected results found regarding the effect of network variables (Capó, 2009).

Sale et al., (2002) give strong arguments for combining quantitative and qualitative methods in a single study. Casebeer and Verhoef (1997) even argue we should view qualitative and quantitative methods as part of a continuum of research. As noted by Clarke and Yaros (1988), combining research methods is useful in some areas of research because the complexity of some phenomena requires data from a large number of perspectives. Closely tied to the arguments for integrating qualitative and quantitative approaches are the benefits that can be obtained from doing so, of which two are recurrent in the literature. The first is to achieve cross-validation by combining two or more sources of data to analyse the same phenomenon (Denzin, 1970). The second, which is more the case in this article, is to obtain complementary results by using the strengths of one method to enhance the other (Morgan, 1998). Research conducted by using different methods can be done simultaneously or sequentially within the umbrella of a main or common project (Tashakkori and Teddlie 2003). Usually one of the methods has more comprehensive relevance to the topic. The supplemental project using the second method may be planned to elicit information that the prime method cannot achieve or to inform in greater detail about some part of the dominant project. In this project, the quantitative approach was the core method, and the qualitative analysis reported in this article was carried out afterwards to supplement the former. The quantitative study in Capó et al. (2007) operationalized a set of relevant attitudinal, background and network variables and combined them into a single regression model predicting performance. This was done through a web survey of PhD students and their supervisors (see Coenders et al., 2007, for details). The goal of the supplementary qualitative study is to understand the PhD students' point of view and to know what or who fostered or hindered their research performance, especially regarding the network variables, which are reported to be relevant in the literature and failed to emerge as such in the quantitative study. In this qualitative study we conducted in–depth interviews with a subset of the students of the same quantitative sample who had been identified either as extreme cases or as typical cases in the original quantitative analysis.

2 Study design

The reason to embark on a qualitative follow−up study was that network variables had failed to predict performance in the quantitative study, despite the empirical evidence in the academic literature and in the management field regarding creative jobs of a comparable complexity to that of a PhD.

We collected data using in-depth interviews (Rubin and Rubin, 1995). Patton (2002) discusses three types of qualitative interviews: a) The *informal conversational interview* is completely unstructured and the questions spontaneously emerge from the natural flow of things during field work, b) in the *interview guide* approach, the topics are prespecified and listed on an interview protocol, but they can be reworded as needed and are covered by the interviewer in any sequence or order, c) the *standardized open–ended interview* is based on open−ended questions and neither the wording nor the sequence of the questions on the interview protocol is varied, so that the presentation is constant across participants. We used the interview guide approach because we wanted interviewees to talk in a natural way. Additionally, each student could report on issues especially relevant for him or her. The interview guide helps us stay on track; helps us ensure that important issues/ topics are addressed; provides a framework for the questions; and helps maintain some consistency across interviews with different respondents. Prior to designing the interview guide we had a conversation with the leaders of the two PhD student unions which are active at the University of Girona in order to identify hot topics.

The interview guide contained only three questions, but respondents were encouraged to also provide additional details through extensive probing by the interviewer. The topics raised by union leaders were also taken into account when asking respondents for details. The questions were worded in such general terms that no clues were provided to the respondent that network variables were actually sought after. The three questions were:

1. Could you explain me your experience of doing your PhD at the University of Girona?
2. Everybody says that publishing is very important for PhD students. Could you explain me your publishing experience?
3. Could you tell me what advice would you give to a new PhD student?

The interviews were conducted by one of the authors of this article between July 2007 and May 2008, four years after the quantitative study. The average duration of the interviews was twenty five minutes.

We used the sampling techniques called *extreme/deviant case sampling* and *typical case sampling*. Using these purposive techniques we sought focus and minimized sample size, so as to select only those cases that best fit the research questions. The extreme/deviant case sampling involves seeking out the most outstanding cases, or the most extreme successes and/or failures, so as to learn as

much as possible about the outliers. On the other hand, typical case sampling seeks those cases that are the most average or representative of the question under study.

In our case, network variables failed to predict performance in the quantitative analysis because the nine cells in Figure 1 were in more or less equal proportions in the quantitative results.

		Research group networking potential		
		Low	Average	High
Performance	Lower than expected	Extreme		extreme
	As expected		typical	
	Higher than expected	Extreme		extreme

Figure 1: Typical and extreme cases regarding networking and performance.

The qualitative analysis started with the identification of a few cases representative of each of the shaded cells in Figure 1. This was done in order to learn which unknown variables make a difference between higher and lower than expected performers given a particular network potential. In order to select respondents we thus need to construct a measure of research networking potential and a measure of meeting the expectation regarding performance.

A measure of networking potential was computed with the assistance of judgement, correlation matrices and principal component analysis of the network measures obtained in the original quantitative analysis regarding the PhD student's research group. Finally the chosen standardized variables and the communalities found in a unidimensional principal component analysis are presented in Table 1. A scree plot showed a clear unidimensional solution: the first dimension explained 53.8% of the variance and the second a mere 15.1%. These results make the computation of networking potential in terms of the sum of the standardized variables in Table 1, reasonable.

Table 1: Indicators of network potential of the research group. Communalities in a unidimensional principal component analysis.

Indicator	Communality
Research group size	.880
Number of different institutions the members of the research group belong to	.222
Sum of contact frequencies between PhD student and research group or external members with the aim of asking for scientific advice	.703
Sum of contact frequencies between PhD student and research group or external members with the aim of collaborating in research	.713
Sum of contact frequencies between PhD student and research group members with the aim of obtaining crucial information, data, software, etc.	.592
Sum of contact frequencies between PhD student and research group members with the aim of engaging in social activities outside working hours	.642
Sum of PhD student trust in research group members in a scale ranging from "complete distrust" to "complete trust"	.925
Sum of subjective probabilities of the PhD student to ask for emotional support to other research group members when confronted with serious problems	.599
Sum of getting on well feelings of PhD students towards research group members in a scale ranging from "very badly" to "very well"	.925

In order to compute a measure of how far performance is above or below prediction, we took the studentized residual in the regression model predicting performance in the former quantitative analysis.

Furthermore, in order to include heterogeneity regarding styles of doing research, the selected students belonged to different fields of study. In the research tradition of the University of Girona two big families of fields of study are distinguished: natural science/technology (nt) versus arts/social sciences (as). Figure 2 shows the PhD students in the quantitative sample plotted according to the residual and the networking potential. The five areas of interest in Figure 1 are also approximately represented. Our initial aim was to select an equal number of students in each of them. However, some of the targeted students could not be contacted because they were no longer at the university and even their PhD supervisors did not know their whereabouts. The students whose label is within a box in Figure 2 were the ones finally interviewed for the qualitative study. The final qualitative sample size was 16.

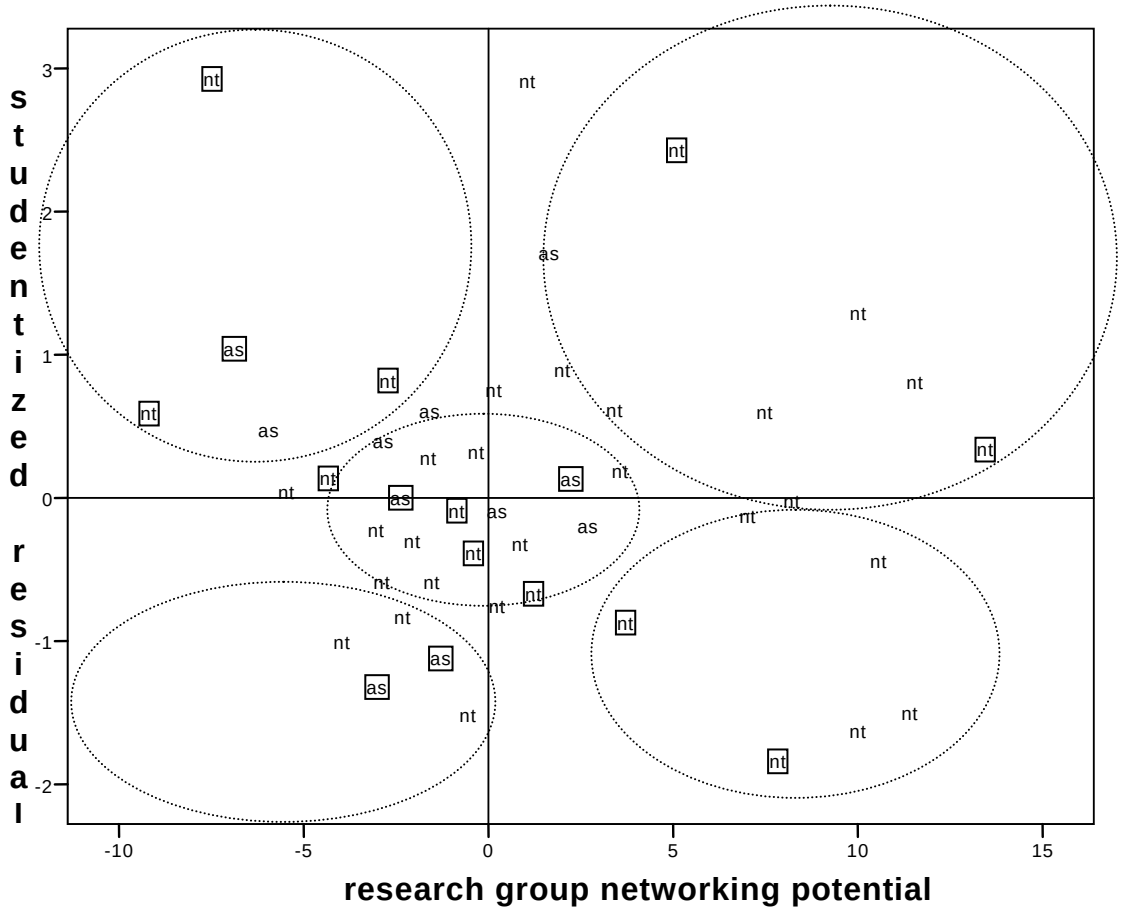

Figure 2: PhD student plot according to the studentized residual and the networking potential obtained from the quantitative analysis. "as": arts/social sciences, "nt": natural sciences/technology. Labels within a box: students interviewed in the qualitative analysis.

The interviews were tape recorded, transcribed verbatim and coded by one of the authors with the help of Atlas.ti software. Another of the authors reviewed the codes and the assignation of paragraphs to codes. We, then, classified the items reported by PhD students either as triggers or hindrances to publishing, and either as related to the student's network or not.

3 Results

3.1 Classification of major topics and student groups

For the interpretation of the results, students were split into two groups, those who had a grant (6 students) and those who were academic teaching staff during their PhD (10 students). This distinction is of high relevance for PhDs in Spain at the time of conducting the study.

1. Some PhD students already belonged to the university staff prior to starting their PhD. At that time, the lowest categories of teaching staff did not require candidates holding a PhD. The members of these categories of course needed a PhD if they wanted to get promoted, which was the reason why many of them actually started a PhD; however no particular deadline is specified for finishing the PhD. Nothing required these PhD students to belong to a research group although in practice it was so in most cases. Teaching was usually their main job. Their average age was relatively high and some even carried out management tasks at university.
2. In the University of Girona, PhD students could obtain grants from the Spanish government, from the Catalan government, from the university itself or from a particular research project. These grants implied that the awarded PhD students had to be members of a research group. These PhD students had to teach no more than 60 hours a year and, therefore, research was their main job. Average age was lower, as most of these students started the PhD immediately after finishing a five-year degree called *licenciatura* in the Spanish university system of the time when the study was conducted. The grant did not imply that the students would later get a permanent position at the university and in fact most of them would end up doing a career in the private sector, notwithstanding their hope for the permanent position (Jacobsson and Gillström, 2006).
3. External PhD students did not fall into any of the two previous categories and were excluded from both the quantitative and the qualitative studies. This type of students usually does not belong to a research group and, thus, studying their research performance from their research group networks does not make sense.

The codes and the count of students mentioning them are shown in Table 2. As we can see, it is easier for the students to speak about what helped them to publish (92+23=115) than about what hindered them from publishing (20+30=50). The fact that 92+20=112 out of the 165 mentioned items have to do with their networks suggest that networks are more important than as found in the quantitative analysis. Moreover, the classification of some of the items as non-network is not completely clear. Visiting other universities during the PhD and lacking economic resources were classified as non-network items. However, the access to other universities or to economic resources can be facilitated by network members with external contacts and with fund-raising abilities.

Table 2: Most often mentioned network and non-network factors that help or hinder performance.

		Times mentioned		
		Overall sample *n*=16	Grant *n*=6	No grant *n*=10
Network-related items helping to publish	High supervisor advice	12	5	7
	Meets researchers outside research group	12	6	6
	Easy meeting with group members	9	4	5
	Group pushes to publish	7	2	5
	Supervisor interested in PhD thesis	7	3	4
	Supervisor teaches to publish	7	4	3
	Group helps during PhD	6	4	2
	Other PhD students in the group	6	3	3
	Supervisor collaboration	5	2	3
	Talk with experts about student's topic	5	3	2
	Group members are friends	4	2	2
	Group with high scientific quality	4	2	2
	Supervisor easy meeting	4	2	2
	Supervisor trust	4	1	3
	Subtotal	92	43	49
Non-network-related items helping to publish	Visit other universities during PhD	6	4	2
	PhD thesis is the student's main task	5	4	1
	Motivation for research	5	2	3
	Motivation for the topic	4	3	1
	The student can plan work by himself	3	2	1
	Subtotal	23	15	8
Network-related items hindering publications	Small research group	6	3	3
	Lonely research	4	2	2
	Low supervisor advice	4	2	2
	Few group meetings	3	3	0
	Lack of PhD students in the group	3	2	1
	Subtotal	20	12	8
Non-network-related items hindering publications	A lot of teaching	7	2	5
	Lack of economic resources	6	2	4
	Lack of time	5	1	4
	Publishing is a slow process	5	1	4
	A lot of administrative work	4	1	3
	Failed experiments or lack of information	3	2	1
	Subtotal	30	9	21

3.2 Supervisors: a matter of quality

The mentioned network items helping to publish are related to the supervisor, the research group and to external researchers. As regards the supervisor, 12 students out of 16 interviewed said that supervisor advice was helpful, especially in the initial stages to get broad strategic orientation "*at some point my supervisors advised me to leave a specific part of the project and move on to another thing, (...) «You're going astray, this is not the way to go»" "your supervisor is very important, especially in the beginning, so that they can lead you one way or*

another. More than anything, they see a chance to do something that hasn't been done yet", but also for problem solving on a regular basis *"any time I've had a doubt, he has always been willing to talk about it (...) above all he wanted me to learn as much as I could"*.

Most of the interviews mentioned the quality of supervisor advice rather than its frequency, as measured by the quantitative study. Seven students mentioned that a good supervisor has to be interested in the student's PhD thesis, which was not considered in the quantitative questionnaire. They referred to them as "*supervisors who have concerned themselves with the thesis. Sometimes you meet people... whose supervisors ignore them a big deal", "I can always count on him, and, well, in fact he has asked me about the research work and has shown interest in it*". Seven of the students considered that supervisors had taught them how to publish, for instance, how to organize the articles and correct the language, *"the first two articles were written almost entirely by my supervisor, I mean, I provided the tables, the figures, all the information, but the writing itself was practically done by my supervisor, and he showed me how it should be done".* Other aspects mentioned were: easily meeting the supervisor "*my supervisor's office door was always open for me, not to mention that we used to have breakfast together"*, being trusted by him or her *"we've known each other for many years now. I trust her completely and I'm sure she trusts me very much"* and collaborating with him or her.

On the negative side we find lack of supervisor advice for a variety of reasons such as, distance *"we really haven't had the chance... because, since we belong to different departments, sometimes it's a bit difficult to meet"*, lack of time *"I haven't been able to see him really often because he is a very busy man"*, or of specialized knowledge *"your thesis supervisor (...) can help you with your research but after some time you are the expert, not him, and he can help you up to a point"*.

3.3 Within and beyond the research group: easily meeting equals

As regards the research group as a whole, most of the students pointed at colleagues as the main source of support for research. Easily meeting research group members was most often mentioned *"they were very disciplined, and every month we did some reading, which helped us achieve group dynamics"*, even the fact of sharing an office or laboratory *"we have a room for students to work in and which functions as well as a library, a meeting room"*.

PhD students can get valuable help from group members because of their availability to ask questions at any moment, which makes it easier than asking the supervisor *"you have many doubts, especially at the beginning, (....) you can't go to your supervisor, say, with a thousand doubts"* and because they are experts in the student's topic *"firstly, they're professionals, they've published a lot, they*

have many years of experience". Six students also considered homophilic relationships as important and mentioned that having other PhD students in the research group helped them because they could best understand their problems *"contacting with people who have the same problems as you can help you find better solutions faster", "you want to be with people your age, people who worry about the things you worry about"*. In the same line, friendship with other group members was also raised *"we are all teaching in the same department, so it is... very easy for us to meet up, and also we all get on well, which is essential (...) This is why if you can't do something, someone else in the group will be able to do it".*

Belonging to a research group which pushes the students into publishing is also helpful. If students feel that their articles are important within the research group, they are more motivated "*it's been so thanks to this policy, the policy of publishing the results you get when you do some research work"*. A number of students also mentioned the scientific quality of the group *"I'm in the most publishing research group at the University of Girona and this also influenced me a little, not just regarding quantity but also quality".*

On the negative side, the interviews also showed that a lack of network contacts hindered students from publishing. This includes small group size *"if you're in a small group and you're the one who knows the most about a certain subject, then you can't consult with anyone", "my group is very small, and I can't really do research the way I could during my stays abroad, where there were many experts, seminars given by foreign professionals, and you could discuss things with them... Here I'd say it's more individual"*, loneliness "*you can talk about your articles with your thesis supervisor, but that's it", "most days I'm alone at home or at the archive, also alone*", few meetings *"each of us was going their own way, we met up from time to time, (...) but we didn't have group dynamics", "one thing I miss here (...) are weekly seminars. (...) I think this kind of communication is lacking here"*, lack of other PhD students in the group *"what we Arts PhD students miss, particularly History PhD students, is group dynamics among students".*

In any case, the quantitative questionnaire did not include any such items as sharing physical spaces, the presence and availability of other PhD students in the group, planned meetings inside the research group or the organization of seminars.

Meeting researchers outside the research group was very frequently mentioned as a positive factor as well *"this kind of contact does help very much, too. If I'd limited myself to the people I know… that would undoubtedly have meant fewer opportunities. (...) and you meet someone and, who knows, the two of you could even start a project together"*. Some students recognized that attending conferences is a good way to meet these researchers *"it's highly advisable to attend speeches, especially at the beginning, so that you can have a sort of database of contacts who might prove helpful at a given time"*. Related to this, visiting other universities during the PhD also helped students. This item is under

the non-network heading but it certainly includes network aspects. A visit to other universities can be considered as a personal experience to know the place and other methods of working *"I think it's essential to go abroad, (...) to learn about another culture and other ways of living and working. I think going abroad is highly important, it can help you grow, for instance, and regarding your PhD it can be very inspiring..."*. However, when the students visit other universities they usually get involved with other researchers *"in Amsterdam I met... this thesis supervisor. He's top in my field of research. He is one of the most influential people in the world".*

3.4 Motivation requires time and resources

Many non-network related matters that helped students to publish are of a rather attitudinal nature: having a high motivation for research as a whole "*I did it very eagerly because it was what I wanted to do*", for the research topic "*I do think you have to like it, and (...) it's better to go happily about it than think... «What a bore, having to do this again»*" and for self planning "*it's important to set a schedule, realistic but ambitious at the same time, so that you can make steady progress with your thesis*".

Working conditions are also mentioned, chiefly among them having the time to concentrate on the thesis as a main task "*during the four years of my PhD I wasn't burdened with additional tasks... for example lectures, so I could spend my time doing research*". Working conditions and time use were also absent from the quantitative questionnaire.

Non-network aspects that hindered students from publishing are also related to the lack of time, either time to get papers published in general terms or, specifically, due to teaching *"since we had to teach, we could not devote all our time and efforts to our theses"* or to administrative work "*from the moment I took up management tasks it is been difficult for me to work on my first degree dissertation and my thesis*".

The lack of resources within the research group hindered them as well *"few resources, especially of a financial nature… and I'm not referring to salaries. I'm talking about material, technical support… this kind of help"*. Research groups obtain their resources depending on their performance and the fund raising ability of certain members, or even, as often mentioned, through sheer size *"it's a small group and (...) I'm happy with my group but I am not with the support we're given"*. This is an argument to take this item as a network item, at least partially. Other mentioned aspects did not have as much to do with hindrances as with the inherent difficulty of the task, such as slow publishing processes or failed experiments.

3.5 To have a grant or not to have it, that is the question

Some qualitative differences emerged between students having a grant and students holding a teaching position (the two last columns of Table 2). Despite the fact that the no-grant group is nearly twice as large, they mention comparatively fewer items. The count of items mentioned is thus close to being equal in both groups (86 for the non-grant group and 79 for the grant group) and thus the counts in both columns are roughly comparable.

Students without a grant have to do extra work at the university. This is why they more often mentioned that doing administrative work or teaching hindered them during their PhD or that they had a lack of time for other reasons or a lack of economic resources. Overall, students without a grant mentioned much more often non-network hindrances.

On the contrary, for students with a grant, non-network items were usually helpful. They more often mentioned, having the PhD thesis as their main task, being motivated for the PhD topic and visiting other universities, as relevant. These visits are easier to carry out when there are no teaching obligations and travel money is available, which is generally the case for students with a grant.

As regards network items, overall they are mentioned about equally by both groups, but differences emerge regarding individual items. All students with a grant mentioned that meeting researchers outside the research group was helpful, which is of course linked to visiting other universities. A further three students mentioned meeting experts as a whole. Most mentioned the help of the group as a whole, but also half of them complained about too few meetings. As regards students without a grant, they more often mentioned the group pushing PhD students to publish and supervisor trust, as most helpful.

3.6 Different field-of-study traditions

Research traditions are strongly linked to the field of study and we also explored whether help and difficulties in publishing were reported by students in a different manner depending on the field of study. The classification of responses according to field of study is not as conclusive as that according to having or not a grant. However, some interesting differences appeared in the expected direction.

All students who complained about small research group size and lack of economic resources were in the scientific and technological fields. Nearly all students who mentioned easy meeting with group members and visiting other universities as helpful factors were also in the scientific and technological fields. It is widely understood that work in large teams on large projects requiring substantial funding are all to find in these fields. As a whole, students in science and techniques mentioned much more often network-related issues.

On the other hand, students in the arts and social sciences fields rather mentioned issues related to the topic of their PhD and to the one-to-one relationship with the supervisor, such as the supervisor being interested in the PhD thesis.

4 Discussion

The original quantitative study in Capó et al. (2007) showed the effect of supervisors' academic performance on the students'. PhD students whose supervisors publish and attend conferences more often will follow the same rule. However, Capó et al. failed to show any positive impact of student–supervisor relationship on student performance. In the current qualitative study, the supervisor emerged even more as a key actor. In addition to performance (likely related to the code "supervisor teaches to publish") we find rather more intangible aspects such as high quality advice, interest in the topic, trust and easiness to meet.

What is really new to the qualitative results is the emergence of variables related to the research group network as a whole, which had no effect in Capó et al. (2007). The quantitative measures of the networks, mostly having to do with presence or absence of contact and its frequency, failed to collect information that is relevant according to the qualitative study, such as support by other young researchers, quality of group performance, expertise of network members, group culture pushing to publish, or even the quality of physical meeting places. In other words, quantitative social network analysis measures alone (centrality, cohesion, etc.) might not be able to grasp the whole impact of network variables on performance. The vast majority of social network analysis literature makes use of quantitative measures to assess the impact of networks on performance (Wasserman and Faust, 1994; Breiger, 2008) but the case analysed in this article shows that, in occasions, this can be misleading. The particular type, characteristics and variety of the resources available thought the network and the behavioural aspects of the relations have been shown to be most relevant to predict the behaviour of the PhD students. These results support the claim made by some literature on social network analysis that the content of ties can matter as much as the structure of the networks. However, most of the literature has only taken into account the latter leaving the former under-researched (Hite, 2005; Ungan et al., 1997; Ahuja, 2000; Powell and Smith-Doerr, 1994). More research is then needed in social network analysis in which the quantitative and qualitative aspects are balanced. Finally, the results of this article suggest a number of useful policies for improving the success of PhD students.

As expected, having a grant emerged as relevant. The obvious implication is the need to offer more grants for PhD students and ensure that PhD students with a grant really have the PhD thesis as the main task, as mandated by law. At the time

the qualitative study was completed, the Spanish ministry was giving 950 yearly grants country-wide, the university of Girona was giving 20 and the regional Catalan government allocated a further 18 to the University of Girona. If we take into account that the country as a whole had 72741 enrolled PhD students in 2007, and Girona only 354, the university and regional grants have a far greater proportional impact than the country grants. In any case, the great majority of PhD students did not have a grant.

The students mentioned lack of resources also as an important factor, often linked to small group size. An obvious policy implication is to improve the resources of high quality groups without considering their size. These resources need not be only financial but can include the allocation of a large number of PhD students with grants, and travel money, as travel and a critical mass of PhD students were commonly reported as important in one way or another.

Finally, the study also revealed that the research group is a key factor of student success. An obvious policy implication is to allocate grants to high performing research groups. At the time of concluding the study, this was being done at the University of Girona, which was giving more weight to the group CV (60%) than to the candidate's CV when allocating grants to groups. The Spanish ministry still allocated a very low percentage to the group CV (10%, although it allocated a further 20% to the Supervisor's CV). The regional government of Catalonia let the individual universities participate in the allocation. In this case, the practice of the University of Girona was to assign only 10% weight to the group CV. Another obvious implication would be to mandate or at least encourage all PhD students' integration in a research group, either having a grant or not.

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